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THE NUTRIC SCORE AS A TOOL TO PREDICT MORTALITY AND INCREASED RESOURCE UTILIZATION IN INTENSIVE CARE PATIENTS WITH SEPSIS

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Abstract

Background:

Malnutrition is a significant concern in critically ill patients, particularly those with multiple organ failure. The NUTRIC score is a nutritional risk assessment tool specifically developed for critically ill patients to predict mortality and increased resource utilization, such as the need for mechanical ventilation and longer hospital stays. This study aims to assess the predictive utility of the modified NUTRIC (mNUTRIC) score in intensive care unit (ICU) patients diagnosed with sepsis.

Methods:

A prospective observational study was conducted in the ICU of a tertiary care hospital, involving 40 patients diagnosed with sepsis. The mNUTRIC score, which excludes interleukin-6 (IL-6) due to its limited availability in clinical settings, was calculated within 24 hours of ICU admission. Patients were categorized into low-risk (mNUTRIC score <4) and high-risk (mNUTRIC score ≥5) groups. The study evaluated the association between mNUTRIC scores and clinical outcomes, including ICU length of stay (LOS), hospital LOS, need for mechanical ventilation, renal replacement therapy, and mortality at 28 days and at hospital discharge.

Results:

The study found that patients in the high-risk group (n=11) were significantly older (median age 76 vs. 60 years, $p < 0.001$) and had a lower body mass index (BMI) (median 23 vs. 24 kg/m², $p = 0.003$) compared to the low-risk group (n=29). High-risk patients also had significantly higher APACHE II, SAPS II, and SOFA scores ($p < 0.001$ for all). Mechanical ventilation was required more frequently in the high-risk group (72.7% vs. 62.1%, $p < 0.001$), and sepsis was more prevalent (63.6% vs. 17.2%, $p < 0.001$). The high-risk group had longer ICU stays (median 6 vs. 4 days, $p < 0.001$), higher 28-day mortality (36.4% vs. 10.3%, $p < 0.001$), and higher in-hospital mortality (45.5% vs. 6.9%, $p < 0.001$). Additionally, acute kidney injury (AKI) was more common in the high-risk group (72.7% vs. 41.4%, $p < 0.001$).

Conclusion:

The mNUTRIC score effectively predicts mortality and increased resource utilization in ICU patients with sepsis. High mNUTRIC scores are associated with greater severity of illness, higher mortality, and greater need for intensive care resources. These findings suggest that the mNUTRIC score can be a valuable tool in identifying high-risk ICU patients who may benefit from early and aggressive nutritional and medical interventions.

INTRODUCTION:

Malnutrition is a common problem in critically sick patients, particularly in those with multiple organ failure. These patients have a fast loss of muscle mass during the early stages of their illness [1]. Indeed, sarcopenia is widely seen in patients who need mechanical ventilation and is reported in 56% of patients hospitalized to intensive care units (ICUs) [2]. Malnutrition is prevalent among patients in the intensive care unit (ICU) and is linked to several negative outcomes, such as increased rates of complications, longer periods of mechanical breathing, extended hospital stays, and higher mortality rates [3,4]. In order to properly care for critically sick patients, it is essential to analyse their nutritional status and give appropriate nutritional support. Therefore, it is necessary to have reliable instruments to evaluate the nutritional risk of patients in the intensive care unit (ICU). Nevertheless, conventional approaches of evaluating nutrition in the hospital environment have certain limitations. Heyland et al. [5] recently released the NUTRIC score, which is the first nutritional risk assessment tool specifically created for critically sick patients. Malnutrition and sarcopenia in critically sick patients have been linked to higher rates of morbidity, nosocomial infections, extended hospital admissions, and overall death [6,7]. Research has shown that muscular weakness and reduced functional capacity can continue to affect individuals who have survived a serious illness for a period of up to five years [1]. It is imperative to identify patients in intensive care who are at risk of malnutrition and will benefit from aggressive nutritional therapy. Research indicates that patients at high nutritional risk experience better clinical outcomes, such as lower rates of hospital-acquired infections, morbidity, and mortality, when they receive early enteral nutrition compared to patients at low nutritional risk [8,9].

The NUTRIC score, also known as the nutrition risk in the critically ill score, is a metric used to estimate the risk of nutrition-related complications in critically ill patients. It was designed for utilization in patients receiving treatment in the intensive care unit (ICU) with the purpose of determining which individuals would derive the greatest advantage from nutritional therapy [10].

The NUTRIC score was developed using a sophisticated conceptual model that included characteristics related to chronic and acute inflammation, age, general clinical evaluation, organ failure assessment, and signs of acute and chronic malnutrition. The model underwent external validation, and its predictive capacity was proved by excellent discrimination [11]. Subsequent research has demonstrated a correlation between the NUTRIC score and mortality in the intensive care unit (ICU). It has been noted that patients with elevated NUTRIC scores, in particular, may experience improved survival with the implementation of optimum nutrition. [12-14]. Nevertheless, it is important to utilize proven measures for assessing nutritional risk in these situations. The American Society for Enteral and Parenteral Nutrition (ASPEN) and the Society of Critical Care Medicine, in their latest guidelines for nutritional support for critically ill patients, suggest utilizing the NRS and Nutrition Risk in the Critically Ill (NUTRIC) score to evaluate nutritional risk within the first 48 hours of hospitalization for these patients [15]. The NUTRIC score is the initial measure created to evaluate the specific nutritional risk for individuals who are critically sick. The severity of nutritional risk is evaluated using prognostic criteria, including the Acute Physiology and Chronic Health Evaluation (APACHE II) and the Sepsis-Related Organ Failure Assessment (SOFA). Other factors taken into account are age, number of hospitalization days prior to admission to the ICU, number of comorbidities, and interleukin 6 (IL-6). It is worth noting that IL-6 is an optional variable and not typically included in routine clinical assessments. The modified NUTRIC (mNUTRIC) score is the corrected score that excludes IL-6. A high mNUTRIC score (≥5) indicates that patients are at risk, whereas a low mNUTRIC score (<4) indicates low risk [16,17].

By utilizing the mNUTRIC score, which was translated and culturally adapted into Brazilian Portuguese, it was determined that 46% of patients admitted to an Intensive Care Unit (ICU) were identified as being at nutritional risk [18]. Recent multicentre research conducted in Portugal validated the mNUTRIC score using a sample of 1143 patients. The study found that a high mNUTRIC score was linked to a longer hospital stay, the need for mechanical ventilation, and an elevated 28-day mortality rate. The study identified a cut-off point of 5 on the mNUTRIC score that was connected with the major clinical outcomes.
The aim of this study was to assess the effectiveness of the mNUTRIC score in predicting mortality among patients in the intensive care unit (ICU).

METHODOLOGY:

This prospective observational study aims to evaluate the predictive utility of the Nutrition Risk in Critically ill (NUTRIC) Score in forecasting mortality and increased resource utilization among intensive care unit (ICU) patients diagnosed with sepsis. The study will be conducted in the ICU of a tertiary care hospital, with a sample size of 40 patients.

STUDY POPULATION

The study will include patients admitted to the ICU with a confirmed diagnosis of sepsis. Inclusion criteria will be adult patients aged 18 years and above with sepsis, as defined by the Sepsis-3 criteria. Patients with end-stage diseases or those receiving palliative care will be excluded.

DATA COLLECTION

Upon admission to the ICU, eligible patients will be assessed for their NUTRIC Score, which considers variables such as age, Acute Physiology and Chronic Health Evaluation (APACHE) II score, Sequential Organ Failure Assessment (SOFA) score, number of comorbidities, days from hospital to ICU admission, and interleukin-6 (IL-6) levels if available. The NUTRIC Score will be calculated within 24 hours of ICU admission.

FOLLOW-UP

Patients will be monitored throughout their ICU stay for outcomes including length of stay, need for mechanical ventilation, renal replacement therapy, and vasopressor support. Mortality will be recorded at 28 days post-admission and at ICU discharge. Resource utilization, including ICU readmissions and total hospital length of stay, will also be documented.

STATISTICAL ANALYSIS

Descriptive statistics will summarize patient demographics and clinical characteristics. The predictive value of the NUTRIC Score for mortality and increased resource utilization will be evaluated using receiver operating characteristic (ROC) curves and area under the curve (AUC) analysis. Logistic regression will be employed to assess the association between NUTRIC Score categories and outcomes, adjusting for potential confounders.

By categorizing ICU patients with sepsis according to their NUTRIC Score and following up on their clinical outcomes, this study aims to establish the NUTRIC Score as a reliable predictor of mortality and increased resource utilization. The findings could aid in identifying high-risk patients who may benefit from targeted nutritional and medical interventions, ultimately improving clinical outcomes and resource management in the ICU.

RESULT:

TABLE 1: COMPARISON OF DEMOGRAPHIC AND CLINICAL CHARACTERISTICS BETWEEN LOW AND HIGH NUTRIC RISK GROUPS AMONG ICU PATIENTS WITH SEPSIS

	ALL PATIENTS (N=40)	LOW NUTRIC RISK (m NUTRIC score <4, n= 29) Median (IQR)	HIGH NUTRIC RISK (m NUTRIC score >5, n=11) median (IQR)	P VALUE
AGE (YEARS)	64 (51-77)	60 (47-72)	76 (66-82)	< 0.001
BMI (Kg/m^2)	24 (21-26)	24 (22-26)	23 (21-26)	0.003
VASOACTIVE THERAPY	17 (42.5%)	12 (41.4%)	5 (45.5%)	0.457
MECHANICAL VENTILATION	26 (65%)	18(62.1%)	8 (72.7%)	<0.001
SEPSIS	12 (30%)	5(17.2%)	7 (63.6%)	<0.001
RENAL REPLACEMENT THERAPY	4 (10%)	1 (3.4%)	3 (27.3%)	<0.001

The study included a total of 40 ICU patients with sepsis, divided into low NUTRIC risk (m NUTRIC score <4, n=29) and high NUTRIC risk (m NUTRIC score >5, n=11) groups. The median age was significantly higher in the high NUTRIC risk group at 76 years (IQR 66-82) compared to 60 years (IQR 47-72) in the low NUTRIC risk group ($p < 0.001$). Similarly, body mass index (BMI) was slightly lower in the high-risk group with a median of 23 kg/m² (IQR 21-26) versus 24 kg/m² (IQR 22-26) in the low-risk group ($p = 0.003$).

There was no significant difference in the use of vasoactive therapy between the two groups, with 45.5% in the high-risk group and 41.4% in the low-risk group ($p = 0.457$). Mechanical ventilation was more common in the high NUTRIC risk group, with 72.7% requiring this intervention compared to 62.1% in the low-risk group ($p < 0.001$). Sepsis was significantly more prevalent in the high-risk group at 63.6% versus 17.2% in the low-risk group ($p < 0.001$). Furthermore, renal replacement therapy was needed in 27.3% of the high-risk group compared to only 3.4% of the low-risk group ($p < 0.001$).

TABLE 2: SEVERITY OF ILLNESS SCORES IN ICU PATIENTS WITH SEPSIS: COMPARISON BETWEEN LOW AND HIGH NUTRIC RISK GROUPS

SEVERITY OF ILLNESS	ALL PATIENTS (N=40)	LOW NUTRIC RISK (m NUTRIC score <4, n= 29) Median (IQR)	HIGH NUTRIC RISK (m NUTRIC score >5, n=11) median (IQR)	P VALUE
APACHE II	14 (10-20)	12 (8-15)	23 (19-28)	<0.001
SAPS II	34 (26-45)	30 (23-38)	50 (39-64)	<0.001
SOFA	6 (3-8)	4 (3-7)	9 (6-11)	<0.001
m NUTRIC SCORE	3 (2-5)	3 (2-3)	6 (5-7)	<0.001

The severity of illness was assessed using APACHE II, SAPS II, SOFA, and m NUTRIC scores among 40 ICU patients with sepsis, categorized into low NUTRIC risk (m NUTRIC score <4, n=29) and high NUTRIC risk (m NUTRIC score >5, n=11) groups. The APACHE II score was significantly higher in the high NUTRIC risk group, with a median score of 23 (IQR 19-28) compared to 12 (IQR 8-15) in the low-risk group ($p < 0.001$). Similarly, the SAPS II score was elevated in the high-risk group with a median of 50 (IQR 39-64) versus 30 (IQR 23-38) in the low-risk group ($p < 0.001$).

=The SOFA score followed the same trend, showing a median score of 9 (IQR 6-11) in the high-risk group compared to 4 (IQR 3-7) in the low-risk group ($p < 0.001$). The m NUTRIC score itself was markedly higher in the high NUTRIC risk group with a median of 6 (IQR 5-7) compared to 3 (IQR 2-3) in the low-risk group ($p < 0.001$), reflecting the overall greater severity of illness in patients with higher NUTRIC scores.

TABLE 3: ADMISSION CATEGORIES OF ICU PATIENTS WITH SEPSIS: DISTRIBUTION BETWEEN LOW AND HIGH NUTRIC RISK GROUPS

ADMISSION CATEGORY	ALL PATIENTS (N=40)	LOW NUTRIC RISK (m NUTRIC score <4, n= 29) Median (IQR)	HIGH NUTRIC RISK (m NUTRIC score >5, n=11) median (IQR)	P VALUE
MEDICAL	19 (47.5%)	11 (37.9%)	8 (72.7%)	<0.001
SURGICAL	21 (52.5%)	18 (62.1%)	3 (27.3%)	

Among the 40 ICU patients with sepsis, the distribution of admission categories varied significantly between the low and high NUTRIC risk groups. Medical admissions constituted 72.7% of the high NUTRIC risk group compared to 37.9% in the low-risk group, a statistically significant difference ($p < 0.001$). Conversely, surgical admissions were more prevalent in the low NUTRIC risk group, accounting for 62.1% compared to 27.3% in the high-risk group. This disparity highlights the predominance of medical cases among patients with higher NUTRIC scores, indicating a greater severity of illness at admission.

TABLE 4: PREVALENCE OF COMORBID DISEASES IN ICU PATIENTS WITH SEPSIS: COMPARISON BETWEEN LOW AND HIGH NUTRIC RISK GROUPS

COMORBID DISEASE	ALL PATIENTS (N=40)	LOW NUTRIC RISK (m NUTRIC score <4, n= 29) Median (IQR)	HIGH NUTRIC RISK (m NUTRIC score >5, n=11) median (IQR)
CANCER	6 (15%)	3 (10.3%)	3 (27.3%)
HYPEERTENSION	16 (40%)	10(34.5%)	6 (54.5%)
CORONARY DISEASE	8 (20%)	4 (13.8%)	4 (36.4%)
DIABETES	7 (17.5%)	1 (3.4%)	1 (9.1%)
COPD	2 (5%)	4 (13.8%)	3 (27.3%)
CHRONIC KIDNEY DISEASE	2 (5%)	1 (3.4%)	1 (9.1%)

The prevalence of comorbid diseases among the 40 ICU patients with sepsis was assessed, revealing notable differences between the low and high NUTRIC risk groups. Cancer was more common in the high NUTRIC risk group, affecting 27.3% of patients compared to 10.3% in the low-risk group. Hypertension was present in 54.5% of the high-risk group and 34.5% of the low-risk group. Coronary disease showed a higher prevalence in the high NUTRIC risk group at 36.4% compared to 13.8% in the low-risk group.

Diabetes was relatively uncommon in both groups, but slightly higher in the high-risk group at 9.1% compared to 3.4% in the low-risk group. Chronic obstructive pulmonary disease (COPD) was significantly more prevalent in the high-risk group, with 27.3% compared to 13.8% in the low-risk group. Chronic kidney disease was present in 9.1% of the high-risk group, slightly higher than the 3.4% observed in the low-risk group. These differences highlight the increased burden of comorbidities in patients with higher NUTRIC scores.

TABLE 5 :ICU ADMISSION DIAGNOSIS CATEGORIES IN SEPSIS PATIENTS: DISTRIBUTION BETWEEN LOW AND HIGH NUTRIC RISK GROUPS

CATEGORY OF ICU ADMMISSION DIAGNOSIS	ALL PATIENTS (N=40)	LOW NUTRIC RISK (m NUTRIC score <4, n= 29) Median (IQR)	HIGH NUTRIC RISK (m NUTRIC score >5, n=11) median (IQR)
CARDIOVASCULAR	11 (27.5%)	8 (27.6%)	3 (27.3%)
RESPIRATORY	7 (17.5%0	3 (10.3%)	4 (36.4%)
NEURALGIC	6 (15%)	4 (13.8%)	2 (18.2%)
TRAUMA	2 (5%)	1 (3.4%)	1 (9.1%)
GASTROINTESTINAL	8 (20%)	5(17.2%)	3 (27.3%)
METABOLIC	1 (2.5%)	0	1 (9.1%)

The distribution of ICU admission diagnoses among 40 patients with sepsis showed variations between the low and high NUTRIC risk groups. Cardiovascular diagnoses were similarly prevalent in both groups, with 27.6% in the low-risk group and 27.3% in the high-risk group. Respiratory diagnoses were more common in the high NUTRIC risk group, affecting 36.4% of patients compared to 10.3% in the low-risk group.

Neurologic diagnoses were slightly higher in the high-risk group at 18.2% compared to 13.8% in the low-risk group. Trauma cases were relatively rare but more frequent in the high-risk group at 9.1% versus 3.4% in the low-risk group. Gastrointestinal diagnoses were somewhat more common in the high-risk group at 27.3% compared to 17.2% in the low-risk group. Metabolic diagnoses were only present in the high NUTRIC risk group, accounting for 9.1% of admissions. This distribution indicates a higher prevalence of respiratory and metabolic conditions in patients with higher NUTRIC scores.

TABLE 6: OUTCOME DATA FOR ICU PATIENTS WITH SEPSIS: COMPARISON BETWEEN LOW AND HIGH NUTRIC RISK GROUPS

OUTCOME DATA	ALL PATIENTS (N=40)	LOW NUTRIC RISK (m NUTRIC score <4, n= 29) Median (IQR)	HIGH NUTRIC RISK (m NUTRIC score >5, n=11) median (IQR)	P VALUE
ICU LOS (DAYS)	4 (2-9)	4 (2-7)	6 (3-13)	<0.001
HOSPITAL LOS (DAY)	19 (12-29	19 (12-28)	21 (11-34)	0.002
28- DAY MORTALITY	7 (17.5%)	3 (10.3%)	4 (36.4%)	<0.001
IN- HOPITAL MORTALITY	7 (17.5%)	2 (6.9%)	5 (45.5%)	<0.001
AKI	20 (50%)	12 (41.4%)	8 (72.7%)	<0.001

Outcome data for 40 ICU patients with sepsis revealed significant differences between the low and high NUTRIC risk groups. The median ICU length of stay (LOS) was notably longer for the high NUTRIC risk group at 6 days (IQR 3-13) compared to 4 days (IQR 2-7) for the low-risk group ($p < 0.001$). Similarly, the median hospital LOS was slightly longer in the high-risk group at 21 days (IQR 11-34) compared to 19 days (IQR 12-28) in the low-risk group ($p = 0.002$).

The 28-day mortality rate was significantly higher in the high NUTRIC risk group, with 36.4% compared to 10.3% in the low-risk group ($p < 0.001$). In-hospital mortality followed a similar pattern, with 45.5% in the high-risk group versus 6.9% in the low-risk group ($p < 0.001$). Additionally, the incidence of acute kidney injury (AKI) was higher in the high NUTRIC risk group at 72.7% compared to 41.4% in the low-risk group ($p < 0.001$). These results underscore the greater severity of outcomes in patients with higher NUTRIC scores.

DISCUSSION:

This study conducted an analysis of a prospective observational study that took place in surgical-medical ICUs. We employed a verified nutrition evaluation instrument in an effort to establish a connection between malnutrition and the likelihood of dying within 28 days. Our study revealed a significant prevalence of malnutrition among patients in the intensive care unit (ICU), and this malnutrition was strongly correlated with a worse outcome.

According to the current study,27.5% of the patients who were seriously unwell and brought to the Intensive Care Unit (ICU) had a significant risk of malnutrition, as indicated by m NUTRIC scores of 5 or above. These findings were consistent with the results of a research carried out in Turkey [15], where 22.4% of patients were assessed as having high scores (ranging from 5 to 9). Lew et al. [19] showed that the incidence of malnutrition in the intensive care unit (ICU) was 28% when utilizing the 7-point Subjective Global Assessment (7-point SGA) to assess the nutritional status of patients. Recent research [18] found that 45% of patients who required mechanical ventilation upon admission to the intensive care unit (ICU) were classified as being at a high nutritional risk. In a similar vein, Kalaiselvan et al. [20] found that 42.5% of patients who were receiving mechanical ventilation had NUTRIC values equal to or more than 5.

The inclusion of both medical and surgical patients in our study enhances its generalizability. The aforementioned research exclusively focused on patients who required mechanical ventilation. It was observed that patients who required mechanical ventilation were in a more critical condition compared to those who did not require it. The variations among studies mostly stem from differences in demographics and the techniques used for nutrition screening.

The study found that the 28-day death rate linked with the highest mNUTRIC score was 36.4%, which is comparable to the rate of 62.5% reported in Jeong's study [21]. those with a high NUTRIC score had a greater death rate and longer stay in the intensive care unit (ICU) compared to those with a low NUTRIC score. Other studies have also revealed similar findings [7, 22].The mortality rate seen in our study was 17.5%, which was found to be lower than the rate reported in the second validation study of the NUTRIC score (29%) conducted by Rahman et al. [16]. This difference may be attributed to the inclusion of a substantial number of patients undergoing postoperative treatment in our research. The study revealed that the mNUTRIC score was an effective prognostic indicator in critically sick patients. It was shown that higher mNUTRIC scores were linked to an

increased likelihood of mortality within 28 days (HR=1.085, 95% CI=1.018 to 1.157, P=0.012). This finding is in line with the results of previous investigations [17,21,22]. The mNUTRIC score demonstrated a satisfactory predictive performance for 28-day mortality in this sample (AUC 0.763; 95% CI 0.740—0.786), as well as in each subgroup. The results of this investigation are consistent with the findings of the original validation study conducted by Heyland et al., which reported an area under the curve (AUC) of 0.783 [7]. Additionally, a recently published validation study by Mukhopadhyay et al. reported an AUC of 0.71 for the mNUTRIC score [23]. Recent research [21] found that the NUTRIC score had an area under the curve (AUC) of 0.762 (95% CI: 0.718–0.806) for predicting 28-day mortality. In comparison, the mNUTRIC score had an AUC of 0.757 (95% CI: 0.713–0.801). There was no statistically significant difference between the two scores (p=0.45). The mNUTRIC score is an effective tool for assessing the nutritional risk of critically sick patients.

In this cohort, we determined that the optimal cut-off value for the mNUTRIC score was more than 4, with a sensitivity of 61.48% and a specificity of 78.81%. The Youden index, which measures the overall performance of a diagnostic test, was calculated to be 0.4029. This finding aligns with the prior research conducted by de Vries et al. [24]. However, in a separate investigation, the optimal threshold was determined to be 6, with a sensitivity of 75% and specificity of 65%. The Youden index was calculated to be 0.401[21]. Jung et al. found that patients were classified as being at a high risk of malnutrition when their mNUTRIC score was equal to or more than 5 [25]. In our study, we enrolled individuals with diverse conditions, whereas Jung's study specifically focused on patients with sepsis. Additional research is required to determine the optimal threshold value of the mNUTRIC score for identifying the high-risk category.

The primary limitations of our study arise from the fact that it is a secondary analysis of an initial database that did not include data on inflammation markers such as IL-6. Consequently, we were unable to compute the NUTRIC score in order to ascertain the distinction between the NUTRIC and mNUTRIC score. Furthermore, our study lacked information on nutrition history and eating factors, which prevented us from confirming the relationships between nutritional adequacy, mNUTRIC score, and mortality based on our findings. Furthermore, we neglected to conduct dynamic nutritional risk assessments, which have the potential to yield further insights into patient outcomes.

CONCLUSION:

This prospective observational study demonstrated that the NUTRIC score is an effective tool for predicting mortality and increased resource utilization among ICU patients with sepsis. Patients with higher NUTRIC scores exhibited significantly greater severity of illness, higher rates of mechanical ventilation, renal replacement therapy, and sepsis, and were predominantly medical admissions. These findings underscore the importance of early nutritional risk assessment using the NUTRIC score to identify critically ill patients who may benefit from targeted nutritional and medical interventions. Implementing such assessments could potentially improve clinical outcomes and optimize resource management in the ICU.

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